

Reducing Volcanic Risk

Living with a **VOLCANO** in Your Backyard
MOUNT RAINIER



Grade Level: 6-12+

Learner Objectives:

Students will:

- Recognize the steps required to reduce volcanic risk
- Identify factors that usually precede an eruption—increased volcanic unrest (seismicity, ground deformation, gas emission)
- Recognize that scientists cannot predict the exact time and size of an eruption, but can estimate the likelihood of an eruption by monitoring volcanic unrest
- Identify some volcanic hazard mitigation methods for consideration at Cascade volcanoes

Setting: Classroom

Timeframe: 45 minutes (video is 22 minutes)

Materials:

- “Reducing Volcanic Risk” video
- VHS video tape recorder



**Living with a Volcano in Your Backyard—
An Educator's Guide with Emphasis on
Mount Rainier**

Prepared in collaboration with the National Park Service

U.S. Department of the Interior
U.S. Geological Survey

General Information Publication 19

Overview

The “*Reducing Volcanic Risk*” video familiarizes students with steps that can be taken to reduce volcanic risk. Steps include: identification of hazardous areas, watching for signs of increased volcanic activity, and assembling and testing emergency plans.

- Television monitor
- Copies of “Reducing Volcanic Risk Questions” student page

Vocabulary: Ash flow, debris flows, emergency plan, hazard, lahar, lava flow, mitigation, monitoring, pyroclastic flow, risk, volcanic ash, volcanic mudflows, volcano hazard map

Skills: Application, interpretation, listening

Benchmarks:

Geography:

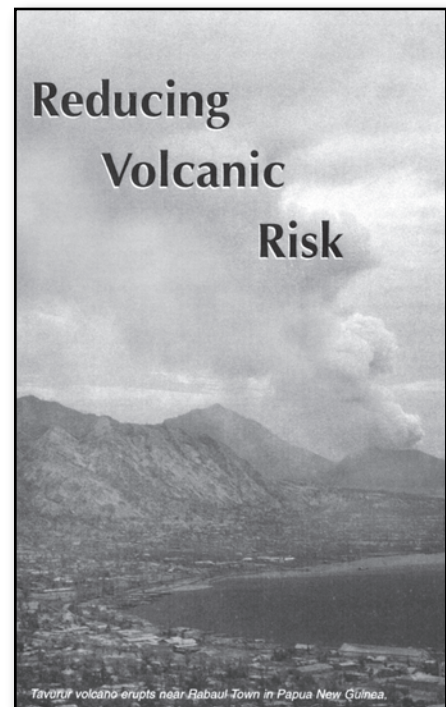
- 3 – The student observes and analyzes the interaction between people, the environment, and culture
 - 3.1 – Identify and examine people's interaction with and impact on the environment
 - 3.1.2a – Analyze the different ways people use the environment, identify the consequences of use, and consider possible alternatives
 - 3.2.2 – Analyze how the environment and environmental changes affect people
 - 3.2.2b – Examine how technology can affect people's interaction with the environment



Teacher Background

This videotape contains dramatic footage of eruptions from around the world that demonstrate how communities have responded to volcanic risk. **Risk** is defined as the loss (human, material, economic) that would result from a disaster, while hazard refers to the source of danger and the possibility of incurring loss or misfortune. Emergency managers use the word mitigation to classify any task intended to make risk less severe, intense, or painful. Following the simple steps described in the video can save lives.

- ◆ **Step 1**—Scientists use historical information and observations of older volcanic rock to identify hazardous areas on a *volcano hazard map*.
- ◆ **Step 2**—Scientists *monitor* the volcano for signs of increased volcanic unrest. Monitoring is defined as the act of observing, recording, and detecting conditions with instruments and visual observations. Most volcanoes shake, swell, and expel increased quantities of gases during the days, weeks or months prior to an eruption. These factors indicate volcanic unrest.
- ◆ **Step 3**—Emergency managers and scientists develop an *emergency plan* because people should know what they must do before the onset of a volcanic eruption. The plan should include the roles of governmental agencies, and procedures for how to inform the population about a volcano's current behavior. A public warning system and evacuation plan can be developed based on the volcano hazard map. The emergency plan should be tested and practiced. Every person at risk from a volcano should know what to do before, during, and after a volcanic eruption. They should be familiar with the terms *ash flow (pyroclastic flow)*, *lava flow*, *volcanic mudflow (lahar)*, and *volcanic ashfall*.



View the video for appropriateness before deciding whether to show it to your students.

Procedure

Learning About Volcanic Risk

1. Explain to students that they will watch a video that shows steps some communities throughout the world take in order to reduce volcanic risk.
2. Ask students to define “risk.”
3. Provide each student with a copy of the *“Reducing Volcanic Risk Questions”* student page.
4. Instruct students to answer questions during or after viewing the video.
5. View the video.
6. Review answers to the questions on the student page as a class. How can students use the steps outlined in the video to reduce risk in the Cascades? Ask students to give specific answers.

Adaptations

- ◆ As an alternative to showing the video, conduct a brainstorming session in which students develop logical steps to address the risk from volcanic hazards in their community.

Extensions

- ◆ Find out what steps have been taken to reduce volcanic risk in your community or in communities around the world.


Assessment

Use students’ responses to questions as an assessment of their ability to recognize steps that reduce risk and to apply information learned from this lesson to a real-world situation.



Resources

- Blong, R.J., 1984, Volcanic hazards—A sourcebook on the effects of eruptions: New South Wales, Academic Press, 424 p.
- Driedger, C., and Scott, K., 2002, Mount Rainier—Learning to live with volcanic risk: U.S. Geological Survey Fact Sheet 034-02, 4 p.
- Dzurisin, D., Stauffer, P.H., and Hendley II, J.W., 1997, Living with volcanic risk in the Cascades: U.S. Geological Survey Fact Sheet 165-97 (revised March 2003), 2 p.
- Hoblitt, R.P., Walder, J.S., Driedger, C.L., Scott, K.M., Pringle, P.T., and Vallance, J.W., 1998, Volcano hazards from Mount Rainier, Washington—1998 volcano-hazards assessment report: U.S. Geological Survey, Open-File Report 98-428, 11 p.
- IAVCEI, 1997, Reducing volcanic risk: International Association of Volcanology and Chemistry of Earth's Interior and United Nations Educational Scientific and Cultural Organization, video 24 minutes.
- IAVCEI, 1997, Understanding volcanic hazards: produced by Maurice Kraft for United Nations Educational Scientific and Cultural Organization and International Association of Volcanology and Chemistry of Earth's Interior, video 26 minutes.
- Kennedi, C.A., Brantley, S.R., Hendley II, J.W., Stauffer, P.H., 2000, Volcanic ash fall—A “Hard Rain” of abrasive particles: U.S. Geological Survey Fact-Sheet 027-00 (revised April 2002), 2 p.
- Myers, Bobbie, Brantley, Steven R., Stauffer, Peter H., and Hendley II, James W., 1998, What are volcano hazards? (revised April 2002): U.S. Geological Survey Fact Sheet 002-97, 2 p.
- Pierce County Department of Emergency Management, 1999, Mount Rainier volcano hazards response plan: Pierce County Department of Emergency Services, 103 p.
- Scarpa, Roberto, and Tilling, R.I., 1996, eds., Monitoring and mitigation of volcano hazards: New York, Springer-Verlag Walter de Gruyter & Co., 841 p.
- Sheets, Payson D., and Grayson, Donald K., eds., 1979, Volcanic activity and human ecology: New York, Academic Press, Inc., 642 p.
- Simkin, Tom, and Siebert, Lee, 1994, Smithsonian Institution Volcanoes of the World, 2nd edition—A regional directory, gazetteer, and chronology of volcanism during the last 10,000 years: Geoscience Press, Inc., Tuscon, Arizona, 349 p. *(Use most recent edition or information on Smithsonian Global Volcanism website)*

 Refer to **Internet Resources Page** for a list of resources available as a supplement to this activity.





Reducing Volcanic Risk Questions

Instructions: Watch the video and answer the following questions.

1. List the three recommended steps to reduce volcanic risk.

🔍 **Identifying Hazardous Areas** -----

2. List three things scientists use to determine what to expect during an eruption.
3. Describe how hazard maps are useful in preparations for responding to volcanic activity.

🔍 **Monitoring Volcanoes** -----

4. Changes at volcanoes commonly provide warning of a possible future eruption.
True or False?
5. List at least three methods used to monitor volcanoes.
6. A scientist can predict the exact time and size of an eruption by monitoring a volcano.
True or False?





Reducing Volcanic Risk Questions - continued

► **Developing an Emergency Plan** -----

7. List the three components of an emergency plan.

8. Describe some steps that could have been taken to prevent the human disaster that resulted from the 1985 eruption of Nevado del Ruiz, Colombia.

► **Difficulties in Emergency Decision-Making** -----

9. Describe what can happen if: (1) emergency officials are too quick to evacuate people near a volcano; (2) if they delay evacuation for too long.

10. Did Mount Pinatubo in the Philippines continue to pose hazards after the end of its 1991 eruption? Explain your answer.

► **Your Community** -----

11. Make a list of activities that could reduce volcanic risk in YOUR community.





Reducing Volcanic Risk Questions

1. List the three recommended steps to reduce volcanic risk.

ANSWER:

Identify hazardous areas

Monitor for signs of increased volcanic unrest

Develop an emergency plan

► Identifying Hazardous Areas -----

2. List three things scientists use to determine what to expect during an eruption.

ANSWER:

Written and oral histories

Detailed studies of volcanic deposits

Identify areas affected by past eruptions

Hazard maps showing distribution of volcanic deposits and relative danger to populated areas

3. Describe how hazard maps are useful in preparations for responding to volcanic activity.

ANSWER:

Hazard maps illustrate areas that are most likely to be affected by future volcanic eruptions. These maps are also useful as a guide to help communities determine safe places to build structures (like water supply reservoirs, dams, bridges, utility stations, schools, etc.) and safe areas for evacuation.

► Monitoring Volcanoes -----

4. Changes at volcanoes commonly provide of warning of a possible future eruption. True or False?

ANSWER:

True





Reducing Volcanic Risk Questions - continued

5. List at least three methods used to monitor volcanoes.

ANSWER:

Widening of ground cracks

Rise or fall of the ground

Changes in volcanic gases

Change in number and type of earthquakes

6. A scientist can predict the exact time and size of an eruption by monitoring a volcano.
True or False?

ANSWER:

False

► Developing an Emergency Plan -----

7. List the three components of an emergency plan.

ANSWER:

Inform the population about hazards

Determine a way to announce warnings

Test and practice the plan

8. Describe some steps that could have been taken to prevent the human disaster that resulted from the 1985 eruption of Nevado del Ruiz, Colombia.

ANSWER:

Informing the population about possible volcanic hazards, better education about volcano hazards, showing the hazard map to the population, developing an emergency plan, testing and practicing the emergency plan.





Reducing Volcanic Risk Questions - continued

► Difficulties in Emergency Decision-Making -----

9. Describe what can happen if: (1) emergency officials are too quick to evacuate people near a volcano; (2) if they delay evacuation for too long.

ANSWER:

Responding too quickly could cause a false alarm. People may ignore future warnings, move back to the dangerous zones near the volcano, or distrust the advice of government officials and scientists in the future. Evacuations cause lots of disruption. If the evacuation is delayed, there may be increased loss of life and property.

10. Did Mount Pinatubo in the Philippines continue to pose hazards after the end of its 1991 eruption? Explain your answer.

ANSWER:

Yes, the volcano was still dangerous for months to years after the eruption. Pyroclastic flows and lahars filled the valleys near the volcano with debris. Rain caused this unstable debris to be mobilized down valleys as lahars, endangering other populations. Scientists were forced to make a new emergency plan.

► Your Community -----

11. Make a list of activities that could reduce volcanic risk in **YOUR** community.

ANSWER:

Preferred answers from the video include making a hazards map, making an emergency plan, and monitoring the volcano. Students might also note they can learn about volcano processes and how volcanoes are monitored, be acquainted with the location of hazard zones in their community, be familiar with evacuation plans in their community, and inquire how public officials advise them to respond.

